

# PATENT ABSTRACTS OF JAPAN

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(11)Publication number :

06-190955

(43)Date of publication of application : 12.07.1994

(51)Int.Cl.

B32B 3/12  
B29B 11/16  
B29B 13/02  
B32B 5/28  
B32B 17/04  
B32B 31/12

(21)Application number : 04-346271

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(22)Date of filing : 25.12.1992

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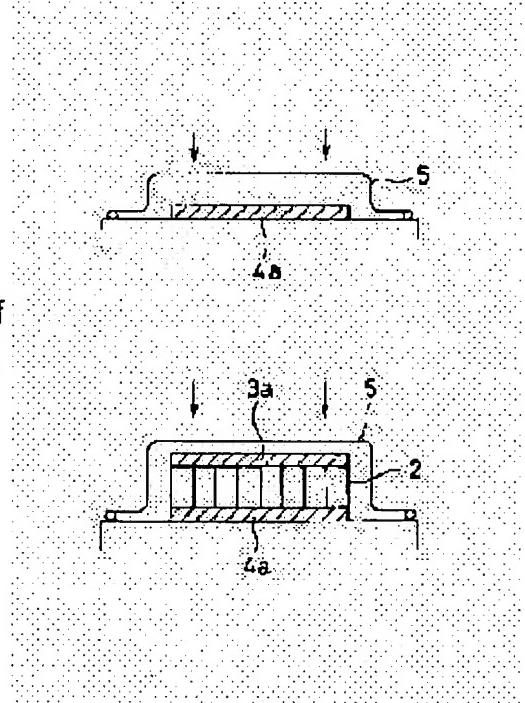
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## (54) PRODUCTION OF HONEYCOMB SANDWICH PANEL

### (57)Abstract:

PURPOSE: To obtain a honeycomb sandwich panel prevented from the generation of voids or resin defect parts in its surface plate and excellent in productivity and heat resistance by a shortened manufacturing process.

CONSTITUTION: A honeycomb core member 2 is placed on a prepreg 4a for a lower surface plate preliminarily molded in viscosity of 80 poise or more under heating and a prepreg 30 for an upper surface plate is laminated on the core member 2 and the whole is integrally molded under heating.



## LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

(19)日本国特許庁 (JP)

(12) 公開特許公報 (A)

(11)特許出願公開番号

特開平6-190955

(43)公開日 平成6年(1994)7月12日

(51)Int.Cl.<sup>5</sup> 識別記号 廷内整理番号 F I 技術表示箇所  
B 3 2 B 3/12 A 7016-4F  
B 2 9 B 11/16 9350-4F  
13/02 9350-4F  
B 3 2 B 5/28 Z 7016-4F  
17/04

審査請求 未請求 請求項の数 1(全 4 頁) 最終頁に続く

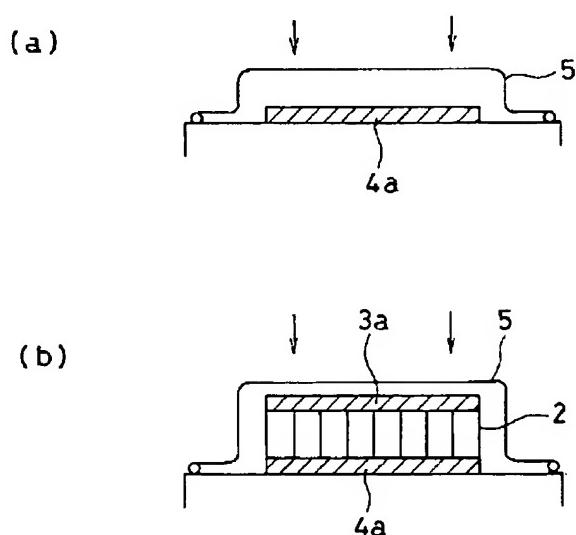
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(54)【発明の名称】 ハニカムサンドイッチパネルの製造方法

(57) 【要約】

**【目的】** 本発明の目的は、表面板にボイドや樹脂欠陥部が発生するのを防止すると共に、製造工程が短く生産性及び耐熱性に優れたハニカムサンドイッチパネルの製造方法を提供することにある。

【構成】 予め80ボイズ以上の粘度に加熱成形してなる下表面板用プリプレグ4a上にハニカム状に形成してなるハニカムコア体2を載置し、このコア体2に上表面板用プリプレグ3aを積層した後、加熱成形して一体的に形成することを要旨とする。



## 【特許請求の範囲】

【請求項1】 予め80ポイズ以上の粘度に加熱成形してなる下表面板用プリフレグ上にハニカム状に形成してなるハニカムコア体を載置し、このコア体に上表面板用プリフレグを積層した後、加熱成形して一体的に形成するハニカムサンドイッチパネルの製造方法。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】本発明は、ハニカムサンドイッチパネルの製造方法に係わり、更に詳しくは表面板にボイドや樹脂欠乏部が発生するのを防止すると共に、製造工程が短く生産性及び耐熱性に優れたハニカムサンドイッチパネルの製造方法に関するものである。

## 【0002】

【従来の技術】ハニカムサンドイッチパネルは、ハニカム状に形成されたハニカムコア体のハニカム孔開口側両面に、該ハニカム孔開口を塞ぐようにしてそれぞれ上下の表面板が一体的に設けられた構成となっている。一般に、表面板が繊維強化プラスチックから構成されているハニカムサンドイッチパネルは、次のようにして製造することが出来る。

【0003】先ず、上下の表面板用のプリフレグを加熱成形して完全硬化させた上下表面板を形成する。続いて該上下表面板の一方の面をそれぞれサンディングする。そして、下表面板のサンディング面上に未硬化のフィルム状接着剤を介してハニカムコア体を積層し、このコア体上に更に未硬化のフィルム状接着剤を介して上表面板を積層した後、加熱成形してハニカムサンドイッチパネルを製造するのである。この方法は、一般に表面板に加熱時の最低粘度が低い樹脂系を用いた場合に行われている。即ち、ゴム系の増粘剤等が添加されていない樹脂系のプリフレグを使用して、耐熱性(180°C)に優れたハニカムサンドイッチパネルを製造するのに用いられる。

【0004】しかし、上述した製造方法は、完全硬化工程が2工程あり、更に上下表面板をサンディングする工程も必要で、工程数が多くて手間がかかると言う問題があった。また、球面形状の構造物に適用すると、構造物用治具に再設定する必要があり、位置合わせやハニカムコア体との接合チェック等を要して生産性が著しく低下すると言う問題があった。

【0005】また、下表面板用プリフレグ上にハニカムコア体を介して上表面板用プリフレグを積層した後、真空バッグ内の減圧下で脱気しながら加熱成形するハニカムサンドイッチパネルの製造方法もある。この方法は、表面板に加熱時の最低粘度が高い樹脂系を用いた場合に行われる。即ち、ゴム系の増粘剤等が添加されているため、120°C程度の耐熱性のハニカムサンドイッチパネルを製造するのに用いられ、製造工程が短く生産性に優れている。しかし、表面板に加熱時の最低粘度が高い樹

脂系を用いた場合、表面板、特に下表面板のハニカム孔に面する部分にボイドや樹脂欠乏部が発生すると言う問題があった。

## 【0006】

【発明が解決しようとする課題】本発明の目的は、表面板にボイドや樹脂欠乏部が発生するのを防止すると共に、製造工程が短く生産性及び耐熱性に優れたハニカムサンドイッチパネルの製造方法を提供することにある。

## 【0007】

【発明を解決するための手段】上記目的を達成する本発明のハニカムサンドイッチパネルの製造方法は、予め80ポイズ以上の粘度に加熱成形してなる下表面板用プリフレグ上にハニカム状に形成してなるハニカムコア体を載置し、このコア体に上表面板用プリフレグを積層した後、加熱成形して一体的に形成することを要旨とするものである。

## 【0008】

【作用】本発明は上記のように構成され、下表面板用のプリフレグが80ポイズ以上あるため、加熱成形時にプリフレグの樹脂の粘度が大きく下がることを抑制して、プリフレグの樹脂がハニカムコア体のハニカム孔内に浸入してハニカム孔面に付着するのを有効に阻止することが可能で、加熱硬化した下表面板にボイドや樹脂欠乏部が発生するのを防止することが出来る。

## 【0009】

【実施例】図1に示すように、ハニカムサンドイッチパネル1は、ハニカム状に形成されたハニカムコア体2のハニカム孔2a開口側の上下両面に、該ハニカム孔2aの開口を塞ぐようにして上下の表面板3、4が一体的に設けられた構成となっている。

【0010】ハニカムコア体2は、従来公知のものから構成することが出来、例えばアルミニウム等の金属やパルサ材等の木材や繊維強化樹脂等からなっている。上下の表面板3、4は繊維強化プラスチックより構成されている。この表面板3、4に使用される樹脂は、従来と同様で特に限定されるものではなく、例えばエポキシ樹脂、ポリエステル樹脂、フェノール樹脂等がある。また、この樹脂中に埋設される補強材も、特に限定されるものではなく、従来同様にガラス繊維、カーボン繊維、アラミド繊維等をクロス状したもの等を使用することが出来る。

【0011】上述した構成よりなるハニカムサンドイッチパネル1を製造する本発明は、以下のようにして行うことが出来る。先ず、図2の(a)に示すように、補強材に樹脂を含浸させたAステージ状のものを真空バッグ5内で減圧して脱気しながら加熱加圧して、Bステージ状の下表面板用のプリフレグ4aを成形する。この時、プリフレグ4aの粘度を80ポイズ以上にすることが重要である。粘度が80ポイズ未満であると、後述する成形時にプリフレグ4aの樹脂がハニカムコア体2のハニ

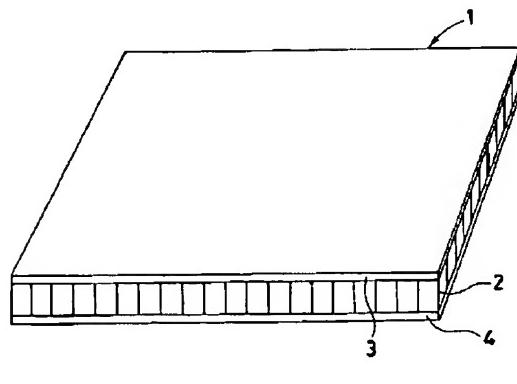
カム孔2a内に浸入し、加熱硬化した下表面板4にボイドや樹脂欠乏部が生じる。好ましくは、100ポイズ以上にするのがよい。

【0012】そして、図2の(b)に示すように、前記プリプレグ4a上に前もって成形されたハニカムコア体2及び上表面板用プリプレグ3aを積層して、再び真空バッグ5内で減圧して脱気しながら加熱加圧し、プリプレグ3a, 4aを完全に硬化してハニカムサンドイッチパネル1を得ることが出来る。この時、下表面板用のプリプレグ4aが80ボイズ以上あるため、加熱時のプリプレグ4aの樹脂の粘度が大きく低下しないので、ハニカムコア体2のハニカム孔2a内に吸い上げられてハニカム孔2a面に浸入付着するのを阻止することが出来、加熱硬化した下表面板4にボイドや樹脂欠乏部の発生が起こらない。

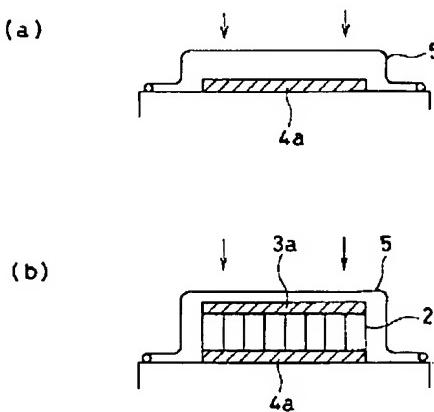
【0013】なお、ハニカムコア体2は、従来同様に（エンドキャップ）して成形しておくとよい。上表面板用プリプレグ3aも従来と同じ粘度（5～20ポイズ）のものを使用することが出来るが、下表面板用のプリプレグ4a同様に、粘度を80ポイズ以上にすることも可能である。以下、本発明を更に具体的に説明する。

【0014】ガラスクロスにエポキシ樹脂を含浸させたAステージ状のものを真空バッグ内で500~760mmHgに減圧して脱気しながら加熱(100℃、300分)して、粘度が約100ポイズのBステージ状の下表面板用のプリプレグを得た。このプリプレグ上にアルミからなるハニカムコア体を積層し、このハニカムコア体上に粘度が80ポイズで上述と同じ構成の上表面板用プリプレグを積層した後、再び真空バッグ内で同様に減圧して

【図1】



〔図2〕



フロントページの続き

(51) Int.Cl.<sup>5</sup>

B32B 31/12

### 識別記号

府内整理番号

7639-4 F

F I

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the manufacture approach of a honeycomb sandwich panel that the production process was short excellent in productivity and thermal resistance while preventing in more detail that a void and a resin starved area occur in a faceplate with respect to the manufacture approach of a honeycomb sandwich panel.

[0002]

[Description of the Prior Art] The honeycomb sandwich panel has the composition that the up-and-down faceplate was prepared in them in one, respectively as this honeycomb hole opening was closed to honeycomb hole opening side both sides of the honeycomb core object formed in the shape of a honeycomb. Generally, the honeycomb sandwich panel with which the faceplate consists of fiber reinforced plastics can be manufactured as follows.

[0003] First, the vertical faceplate which hot forming of the prepreg for up-and-down faceplates was carried out [ faceplate ], and carried out full hardening is fabricated. Then, sanding of one field of this vertical faceplate is carried out, respectively. And after carrying out the laminating of the honeycomb core object through non-hardened film glue on the sanding side of a following table face-plate and carrying out the laminating of the upper faceplate through non-hardened film glue further on this core object, hot forming is carried out and a honeycomb sandwich panel is manufactured. This approach is performed when a resin system with the low minimum viscosity at the time of heating is generally used for a faceplate. That is, it is used for using the prepreg of the resin system by which the thickener of a rubber system etc. is not added, and manufacturing the honeycomb sandwich panel excellent in thermal resistance (180 degrees C).

[0004] However, the full hardening process was required also for those with 2 processes, and the process which carries out sanding of the vertical faceplate further, and the manufacture approach mentioned above had the problem which a routing counter says and takes time and effort. Moreover, when applied to the structure of a spherical-surface configuration, it needed to reset to the fixture for the structures and there was a problem said that alignment, a junction check with a honeycomb core object, etc. are required, and productivity falls remarkably.

[0005] Moreover, after carrying out the laminating of the prepreg for upper faceplates through a honeycomb core object on the prepreg for following table face-plates, there is also the manufacture approach of the honeycomb sandwich panel which carries out hot forming, deaerating under the reduced pressure in a vacuum bag. This approach is performed when a resin system with the high minimum viscosity at the time of heating is used for a faceplate. That is, since the thickener of a rubber system etc. is added, it is used for manufacturing the heat-resistant honeycomb sandwich panel which is about 120 degrees C, and the production process is short excellent in productivity. However, when a resin system with the low minimum viscosity at the time of heating was used for a faceplate, the problem said that a void and a resin starved area occur was in the part which faces the honeycomb hole of a faceplate, especially a following table face-plate.

[0006]

[Problem(s) to be Solved by the Invention] While the purpose of this invention prevents that a void and a resin starved area occur in a faceplate, a production process is to offer the manufacture approach of a honeycomb sandwich panel of having excelled in productivity and thermal resistance short.

[0007]

[The means for solving invention] After the manufacture approach of the honeycomb sandwich panel of this invention of attaining the above-mentioned purpose lays the honeycomb core object which it comes to form in the shape of a honeycomb on the prepreg for following table face-plates which comes to carry out hot forming to the viscosity of 80poise or more beforehand and carries out the laminating of the prepreg for upper faceplates to this core object, it makes it a summary to carry out hot forming and to form in one.

[0008]

[Function] It can prevent that a void and a resin starved area occur in the following table face-plate which this invention was constituted as mentioned above, and having prevented effectively was possible and carried out heat hardening of the prepreg for following table face-plates controlling that the viscosity of the resin of prepreg falls greatly by 80poise or more at the time of hot forming for a certain reason, and the resin of prepreg permeating into the honeycomb hole of a honeycomb core object, and adhering to honeycomb \*\*\*.

[0009]

[Example] As shown in drawing 1, the honeycomb sandwich panel 1 has the composition that the up-and-down faceplates 3 and 4 were formed in them in one as opening of this honeycomb hole 2a was plugged up to vertical both sides by the side of honeycomb hole 2a opening of the honeycomb core object 2 formed in the shape of a honeycomb.

[0010] The honeycomb core object 2 can be conventionally constituted from a well-known thing, for example, consists of wood, fiber strengthening resin, etc., such as aluminum. [, such as a metal and balsa material, ] The up-and-down faceplates 3 and 4 consist of fiber reinforced plastics. The resin used for these faceplates 3 and 4 is especially the same as usual, is not limited, and has an epoxy resin, polyester resin, phenol resin, etc. Moreover, the reinforcing materials laid underground into this resin are not limited especially, either, and can use what carried out the letter of a cross of a glass fiber, carbon fiber, the aramid fiber, etc. as usual.

[0011] As this invention which manufactures the honeycomb sandwich panel 1 which consists of a configuration mentioned above is the following, it can be performed. First, heating pressurization is carried out decompressing and deaerating the A stage-like thing into which resin was infiltrated within the vacuum bag 5 to reinforcing materials, as shown in (a) of drawing 2, and prepreg 4a for B stage-like following table face-plates is fabricated. At this time, it is important to make viscosity of prepreg 4a into 80poise or more. The resin of prepreg 4a permeates into honeycomb hole 2a of the honeycomb core object 2 at the time of shaping later mentioned as viscosity is less than 80poise, and a void and a resin starved area arise in the following table face-plate 4 which carried out heat hardening. Preferably, it is good to make it 100poise or more.

[0012] And as shown in (b) of drawing 2, the laminating of the honeycomb core object 2 beforehand fabricated on said prepreg 4a and the prepreg 3a for upper faceplates is carried out, heating pressurization can be carried out decompressing and deaerating within the vacuum bag 5 again, Prepregs 3a and 4a can be hardened completely, and the honeycomb sandwich panel 1 can be obtained. Since the viscosity of the resin of prepreg 4a at the time of heating does not fall [ prepreg 4a for following table face-plates ] greatly by 80poise or more at this time for a certain reason, it is sucked up in honeycomb hole 2a of the honeycomb core object 2, and generating of a void or a resin starved area does not take place to the following table face-plate 4 which could prevent carrying out permeation adhesion to the honeycomb hole 2a page, and carried out heat hardening to it.

[0013] In addition, the honeycomb core object 2 of fabricating conventionally similarly (end cap) is good. It is also possible \*\*\*\*\* to make viscosity into 80poise or more at the prepreg 4a said appearance for following table face-plates, although prepreg 3a for upper faceplates can also use the thing of the same viscosity (5-20poise) as the former. Hereafter, this invention is explained still more concretely.

[0014] It heated, decompressing and deaerating the A stage-like thing which infiltrated the epoxy resin into glass fabrics to 500 - 760mmHg within a vacuum bag (100 degrees C, 300 minutes), and the prepreg for the following table face-plates of the shape of a B stage whose viscosity is about 100poise was obtained. After it carried out the laminating of the honeycomb core object which consists of aluminum on this prepreg and viscosity carried out the laminating of the prepreg for upper faceplates of the same configuration as \*\*\* by 80poise on this honeycomb core object, heating pressurization (180 degrees C, 2.5kg/cm<sup>2</sup> x 120 minutes) was carried out in the autoclave, having decompressed similarly and deaerating within a vacuum bag, again, and the honeycomb sandwich panel of the configuration shown in drawing 1 was obtained. In addition, the thickness of a vertical faceplate is 0.75mm, respectively. The obtained honeycomb sandwich panel does not have generating of a void or a resin starved area in the part which faces the honeycomb hole of a following table face-plate, either, and was excellent in quality.

[0015]

[Effect of the Invention] Since the prepreg for following table face-plates is beforehand constituted by 80poise or more as mentioned above, this invention can prevent effectively that the resin of said prepreg permeates into the honeycomb hole of a honeycomb core object at the time of hot forming. Consequently, it can prevent that a void and a resin starved area occur in the following table face-plate which carried out heat hardening, and the honeycomb sandwich panel excellent in endurance can be obtained. Moreover, the production process of the honeycomb sandwich panel by the resin system with the low viscosity by which the thickener of a rubber system etc. is not added can be shortened, and the productivity of the honeycomb sandwich panel excellent in thermal resistance can be improved sharply.

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